

**Claims of the invention**

1. Brightness preserving laser beam shaper designed to make symmetrical and to  
5 focus highly asymmetrical light beams, for instance that of laser diode bars,  
characterized in that the beams in the direction of fast ( $y$ ) and slow ( $x$ ) axes are  
focused by independent optical surfaces of quasi-cylindrical lenses and that the first  
focusing element of the shaper – the fast axis collimator is located in such a  
distance in respect to the light source that the light source in the direction of the fast  
10 axis is imaged directly into the output plain of the shaper.
2. Brightness preserving laser beam shaper as claimed in claim 1, characterized in  
that it consists only of three optical elements where the first element – quasi-  
cylindrical lens – images the light source in the direction of fast axis and the two  
multi-segment elements where the first of the elements may be, for instance, multi-  
15 edged prism and the second one – glass plate set with appropriate input and output  
surfaces separate and redistribute the beams and image the light source in the  
direction of the slow axis.
3. Brightness preserving laser beam shaper as claimed in claim 1, characterized in  
that surface segments of the first multi-segment element that refracts the initial  
20 asymmetrical beam are shaped so that different beams or parts of these when  
refracted in the above mentioned surfaces gain different propagation directions,  
which are such that beyond the certain distance secondary beams do not overlap  
and their weight centres are ranked one over another in the direction of the fast ( $y$ )  
axis where their propagation directions are made uniform by the second multi-  
25 segment element.
4. Brightness preserving laser beam shaper as claimed in claim 1, characterized in  
that the segments of the surface of the first multi-segment element are shaped so  
that they compensate the aberration that occurs because of the light source bending,  
which in laser diode bar optics is called “smile” distortion.
- 30 5. Brightness preserving laser beam shaper as claimed in claim 1, characterized in  
that when the distances between the different emitters in the laser diode bar are  
relatively large – such that the beams do not overlap after the fast axis collimator,

the beam separating multi-segment element is located as close as possible to the light source, i.e. in the near field.

6. Brightness preserving laser beam shaper as claimed in claim 1, characterized in that the multi-segment element that splits the initial asymmetrical beam is in the far field of the initial beam, when after the first focussing element it becomes impossible to separate the individual beams because they overlap.
7. Brightness preserving laser beam shaper as claimed in claim 1, characterized in that the surfaces of the segments of the initial beam separating multi-segment element are directed so that they would distort the separated beams as minimal as possible, i.e. the side beams that comprise the initial beam are directed towards the slow axis so that they would move away from the  $xOz$  plain as less as possible and the central beams that comprise the initial beam are directed towards the fast axis so that they would move away from the  $yOz$  plain as less as possible.
8. Brightness preserving laser beam shaper as claimed in claim 1, characterized in that having split the initial asymmetrical beam in the far field, the field curvature aberration of the first focusing element is corrected by the surfaces of different segments of beam splitting multi-segment element, for instance, by quasi-cylindrical surfaces that also act as cylindrical lenses in the direction of the fast ( $y$ ) axis with decreasing focusing power, having moved away in both directions from the shaper axis ( $z$ ).
9. Brightness preserving laser beam shaper as claimed in claim 1, characterized in that having split the initial asymmetrical beam in the near field, the field curvature aberration of the first focusing element is corrected by the input surfaces of different segments of the second multi-segment element, which make the secondary beam directions uniform and act as cylindrical lenses in the direction of the fast ( $y$ ) axis with equally decreasing focusing power, having moved away in both directions from the shaper axis ( $z$ ).
10. Brightness preserving laser beam shaper as claimed in claim 1, characterized in that the surfaces of the second multi-segment element output are of quasi-cone shape and are optimised so that the beams propagating in the second multi-segment element along the  $z$ -axis are focused by the above mentioned surfaces in the direction of the slow ( $x$ ) axis to the output plane of the shaper and are directed to the output focus of the shaper in the direction of fast ( $y$ ) axis.

11. Brightness preserving laser beam shaper as claimed in claim 1, characterized in that the surfaces of optical elements that comprise the shaper are not the plains but optimized surfaces of the second and higher order, for instance, these of the bent propeller shape, by which the aberrations of optical system are corrected and that in any point of these surfaces tangential plain touches the surface through the straight line and these surfaces may be manufactured employing conventional surface processing methods using digital positioning.
12. Brightness preserving laser beam shaper as claimed in claim 1, characterized in that using additional polarising or dichroic mirror the beams of the two laser diode bars after the first multi-segment elements (4) are coupled into the second common multi-segment element (6), and using the sources of the two different wavelengths one can combine radiation of four laser diode bars using two polarising and one dichroic mirror.
13. Brightness preserving laser beam shaper as claimed in claims 1, 2 and 5, characterized in that while shaping laser diode stack radiation, the beams of two (or more) laser diodes of one bar in the first multi-segment elements (4) are directed into the one plate of the second multi-segment element (6), input surfaces of which unify beam propagation directions and output surfaces (8) focus the beams in the direction of the slow axis and direct them into the common focus of the shaper.